EFFECTS OF FEEDING DEHYDRATED ALFALFA PELLETS UPON SOME FAT CONSTANTS OF BUTTERFAT

by

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INTRODUCTION

Alfalfa has long been used as a roughage for dairy cattle. It is also frequently used with other roughages such as pasture, silage or other hays. Alfalfa can be fed as long hay, chopped hay or perhaps also as pellets.

Dehydrated alfalfa pellets have several advantages over long hay in the rations of dairy cows. Among these may be mentioned the saving of storage space and reduced waste. Pellets also are easier to handle than long hay. One pound of dehydrated alfalfa pellets has been estimated (1) to have the vitamin content of two pounds of alfalfa hay. Another advantage would be in the preparation of mixed feeds in which the pellets can be ground with other feeds.

REVIEW OF LITERATURE

Powell (19) reported that the feeding of the entire roughage in the finely ground form results in a decrease in both production and fat content of milk. However, Espe and Cannon (13) found that the percentage of fat in milk was not influenced by grinding the roughage to a meal. A study using long or finely ground alfalfa was made by Cole and Mead (8). They observed the following undesirable symptoms only when the finely ground roughage was fed: irregular rumination, frequent bloat, depraved appetites, and reduced food consumption when compared with the consumption of long alfalfa.

Many factors have been considered in relation to differences in the composition and properties of butter and butterfat. Eckles and Palmer (11) made a study of the influence of overfeeding, and observed what they called normal Reichert-Meissl and saponification numbers. Later in a study of underfeeding (12) they reported an increase in the iodine number and a decrease in saponification and Reichert-Meissl numbers. Variable results were reported on the melting points.

It has been reported that the Reichert-Meissl and iodine numbers of Irish butter (2) and Welsh butter (10) show a seasonal change. Other workers have reported similar results. In a study of the seasonal changes in the properties of butterfat in Oregon, Stout and Stein (25) reported the iodine and Reichert-Meissl numbers were highest during the spring months and lowest during the winter months. Others (9, 18, 24) also have reported that either the iodine or Reichert-Meissl numbers are low in winter and high in spring. There is one conflicting report (23). These differences have been attributed to changes in temperature or foods.

Hilditch and Sleightholme (18) suggested that changes of seasonal temperature result in a change in the composition of butter. Frey, Cannon, and Bird (14, 15) found a relationship between the external temperature and the iodine number of butterfat. However, Hansen and Shaw (16) reported that low and rapidly changing temperatures did not influence the iodine or Reichert-Meissl numbers of butterfat produced on an alfalfa hay ration. Bartley et al. (5) also reported that temperature changes did not materially affect the iodine number.

Several workers have reported effects of feeding experiments with alfalfa and its relation to the properties and composition of butter. There appears to be some conflict in the reported effects of alfalfa hay upon the Reichert-Meissl and iodine numbers of butterfat. Hansen and Shaw (16) reported that an alfalfa hay ration would decrease the Reichert-Meissl number and increase the iodine number. This was in agreement with the findings of Richardson and Abbott (20). Wilster, Jones, and Haag (29) observed that when alfalfa hay was the sole ration the butterfat was low in both Reichert-Meissl and iodine numbers. The addition of grain increased the Reichert-Meissl number and decreased the iodine number.

Other factors such as breed and stage of lactation (5, 16, 18) are also reported to affect the Reichert-Meissl and iodine numbers of butterfat. However, these factors were taken into consideration in the grouping of the cows used in this experiment.

Modifications of the Hanus (3, 17), Wijs (3, 28), and Winkler (4, 27, 30) methods have long been used to determine iodine numbers. Later a pyridine sulfate dibromide method was developed by Rosenmund and Kuhnhenn (21). This method was modified by Yasuda (31) in determining the iodine number of lipids. Also this method was used by Bird[1] to determine the iodine number of butterfat. Bird suggested that the pyridine sulfate dibromide method is more suitable than the other methods in determining the iodine numbers of butterfats. He found that the Wijs method yields high values with butterfat and that the Hanus and pyridine sulfate dibromide methods check within a few per cent only if exactly equivalent quantities of bromine and iodine were used in preparing the Hanus reagent.

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[1] Prof. E. W. Bird, Iowa State College, Ames. Private communication.

At this point it might be reported that the method of Toms (26) was unsuccessfully tried in this laboratory. Bird also agrees that this method is not adaptable to butterfat.

The object of the present experiment was to determine if machine cured alfalfa pellets could take the place of pasture in maintaining the high iodine number of spring butter.

PROCEDURE

Four series of feed trials using nine different rations were used by the Department of Dairy Husbandry to compare dehydrated chopped or pelleted alfalfa with chopped sun-cured alfalfa hay. The first series was not designed to differentiate direct effects of feed on fat quality from indirect effects through changes in amounts of milk and fat produced. In Series 2 and 3 the planes of nutrition and production were not greatly changed and will be discussed elsewhere (6). In Series 4, production was decreased much less by the dehydrated hay than by the pellets in Series 1 but here also part of the change in fat constants may have been due to changes in production. In each series the groups of cows were made as similar as possible in regard to milk production, stage of lactation, weight, and breed. Cream samples from milk produced during each of the 4 series were obtained for analysis of fat constants.

An aliquot of each milking for the last two days of each week was collected from each cow. These aliquots were composited for each group of cows in the first series of feeding trials and for each individual cow in other series. Each composite was pasteurized 30 minutes at 143° F. and separated in a Sharples supercentrifuge. To determine if there was sufficient enzyme oxidation during storage to change the iodine number, on three occasions the milk composite from each cow was divided into two parts. One portion was pasteurized and the other left raw. The creams thus obtained by the Department of Dairy Husbandry were stored at 5° C. until churned.

Details of the nine rations are shown in Table 1. The four series of feeding programs are indicated in Table 2. In Series 1, three groups of six cows each were used to compare rations A, B, and C. A single reversal trial with periods of 10 weeks and 6 weeks was used.

Another feeding period was started after the sixteenth week. However, physiological disturbances caused some of the cows to be withdrawn and some feeds to be modified. Therefore, no interpretation of fat constants obtained during this period can be made.

Two other groups of six cows each were used in Series 2 of the experiment to compare ration E containing 17 per cent dehydrated alfalfa pellets with ration D (control). In Series 3 two groups of seven cows each were used. In this series ration F, in which about 35 per cent of the roughage was dehydrated alfalfa pellets, was compared with ration D. Both Series 2 and 3 were double reversal trials.

Series 4 was designed to test effects of machine dehydrating without grinding the roughage. Two groups of three cows each were used in this series. Both groups were on ration G for two weeks. Group VIII was then two weeks on ration H followed by two weeks on ration J. Group IX received ration J for two weeks followed by ration H for two weeks.

Table 1. Rations used in the experiments.

Ration	Composition
A	Grain mixture*, chopped sun-cured alfalfa hay
B	Grain mixture, dehydrated alfalfa pellets
C	Grain mixture, chopped sun-cured alfalfa hay (25%), dehydrated alfalfa pellets (75%)
D	Grain mixture, chopped sun-cured alfalfa hay, silage
E	Grain mixture, chopped sun-cured alfalfa hay, dehydrated alfalfa pellets (½ lb. per 100 lbs. body weight), silage
F	Grain mixture, chopped sun-cured alfalfa hay, dehydrated alfalfa pellets (1 lb. per 100 lbs. body weight), silage
G	Grain mixture, pasture
H	Grain mixture, chopped sun-cured alfalfa hay
J	Grain mixture, chopped dehydrated alfalfa hay

* Grain mixture: Corn, oats, bran, soybean oil meal, salt, bone meal.

Table 2. Plan of the feeding experiments.

Experimental periods	Days duration	Series	Group I	Group II	Group III
Period 1	70	1	Ration B	Ration A	Ration C
Period 2	42	1	Ration A	Ration B	Ration C
			Group IV		Group V
Preliminary period	14	2	Ration D		Ration E
Period 3	21		Ration D		Ration E
Preliminary period	14	2	Ration E		Ration D
Period 4	21		Ration E		Ration D
Preliminary period	14	2	Ration D		Ration E
Period 5	21		Ration D		Ration E
			Group VI		Group VII
Preliminary period	14	3	Ration D		Ration F
Period 6	21		Ration D		Ration F
Preliminary period	14	3	Ration F		Ration D
Period 7	21		Ration F		Ration D
Preliminary period	14	3	Ration D		Ration F
Period 8	21		Ration D		Ration F
			Group VIII		Group IX
Period 9	14	4	Ration G		Ration G
Period 10	14	4	Ration H		Ration J
Period 11	14	4	Ration J		Ration H

Near the end of the experiment there appeared an article by Benham and Klee (7) concerning the use of mercuric acetate catalyst in determining iodine numbers by the pyridine sulfate dibromide method. They tested their method on many fats but did not include butterfat. The iodine number of butterfat was determined in a series of experiments with and without catalyst. A much lower amount of catalyst was necessary than the 250 mg used by Benham and Klee. As a catalyst 1 ml of 0.10 per cent mercuric acetate solution was found to be adequate. Fresh catalyst was prepared daily. The only change in procedure was an increase in the per cent potassium iodide solution used.

To prepare a sample for analysis, the butterfat was first melted in warm water. Then approximately 0.07 g of butterfat was weighed into a 25 ml volumetric flask and dissolved in chloroform. A 10 ml aliquot was added to each of two iodine flasks. The stopper of each flask was sealed with a drop of phosphoric acid.

The pyridine sulfate dibromide reagent was prepared at a strength of approximately 0.05 N. A specially constructed pipette was used to add the reagent to the iodine flask.

The reagent was added to the flask as follows: the pipette was allowed to fill with the reagent until the upper mark was reached. Then the stopper of an iodine flask was removed and the flask placed under the tip of the apparatus. The lower stopcock was opened and the reagent was allowed to drain rather rapidly into the flask. When the pipette was about three-fourths empty the pressure was lowered so that the reagent slowly drained into the flask. By allowing the reagent to drain slowly into the flask it was possible to accurately control the amount of brominating reagent added to the flask.

After the reagent was added to the iodine flask, the flask was sealed with a drop of potassium iodide solution. The flask was then placed in the dark for 15 minutes and the reaction stopped by adding five ml of a 2 per cent potassium iodide solution. Immediately after the addition of the potassium iodide the liberated iodine was titrated to a pale yellow color using exactly 0.02 N sodium thiosulfate. Then two ml of a 1 per cent starch solution was added and the titration continued until the end point was reached. Approximately 0.10 N sodium thiosulfate was standardized and a portion of this concentration diluted to the strength used in the titrations.

The Reichert-Meissl and Polenske numbers were determined using the AOAC method (3).

RESULTS

Tables 3 to 9 contain all data collected concerning the fat constants. It will be observed that the Reichert-Meissl, Polenske, and iodine numbers are not given for each sample in the tables. This was partly due to the fact that many samples obtained during the early weeks of the experiment were too small to permit analysis for all of the fat constants. To permit tests on an unexpectedly large number of samples many of the later samples were analyzed for iodine numbers only.

The fat constants given in Tables 3 and 4 are for Groups I, II, and III of Series 1. Results given in Table 4 are not subject to interpretation due to variations in cows and feeds.

Tables 5 and 6 contain the Reichert-Meissl, Polenske, and iodine numbers obtained from butterfat produced when a portion of the roughage was alfalfa pellets. However, in Tables 7 and 8 only iodine numbers are recorded. Iodine numbers found in Table 8 were determined with and without mercuric acetate as a catalyst. Iodine numbers for Series 4 are found in Table 9. Statistical analyses of the data obtained during the experiment are given in Tables 10 to 23.

Table 3. Fat constants of butterfat from pasteurized milk composited from three groups of six cows each and for two individual cows in one group. Cows were fed alfalfa hay (Ration A), alfalfa pellets (Ration B), and a hay and pellet mixture.

Cow	Constant	1949		1950						
		Dec.7	Dec.28	Jan.4	Jan.11	Jan.18	Jan.25	Feb.8	Feb.15	Feb.22
		5	8	9	10	11	12	14	15	16
Group I	R-M	24.3	24.5	24.2		26.6	26.2	25.5	27.9	28.1
	Pol.	2.3	2.0	2.0		2.8	2.8	3.2	2.5	1.6
	Iod.					34.5	31.7	31.0	29.6	27.3
Group II	R-M	29.2	29.8	27.2	27.6	27.8	28.1	23.6	24.3	26.8
	Pol.	3.7	2.9	2.3	2.9	1.9	3.8	3.0	2.8	2.2
	Iod.					34.1	37.8	36.0	39.4	33.1
Group III	R-M	25.2	25.8	29.2	26.0	26.3	25.3	24.5	26.4	27.1
	Pol.	3.3	3.7	2.3	3.4	2.9	2.2	3.6	2.8	2.5
	Iod.					35.7	36.5	35.2	34.5	29.3
145	R-M		26.5	22.3	23.9				28.1	
	Pol.		2.4	1.7	2.7				3.1	
	Iod.					36.5			31.4	
163	R-M		17.5		11.6	21.9	24.6	24.4	26.2	
	Pol.		1.1		1.5	1.7	2.2	3.2	2.3	
	Iod.					39.6	36.5	35.7	31.4	

Table 4. Fat constants from three groups of cows and for two individual cows representing the extreme variations fed rations of varying composition.

Cow	Constant	1950								
		Mar.1 17	Mar.8 18	Mar.15 19	Mar.22 20	Mar.29 21	Apr.5 22	Apr.12 23	Apr.19 24	Apr.26 25
Group I	R-M	28.0	26.8	15.4	25.8	24.8				
	Pol.	2.5	2.4	3.3	2.0	2.2				
	Iod.	31.1	32.5	34.4	34.6	36.6	41.0	39.8	29.8	37.4
Group II	R-M			26.0	23.7	26.6				
	Pol.			1.7	2.1	3.0				
	Iod.			37.6	33.7	28.4	32.5	33.3	37.6	27.6
Group III	R-M	26.0		24.7	25.1	27.2				
	Pol.	2.5		2.3	2.3	2.3				
	Iod.	32.0	32.7	29.8	33.4	34.2	36.7	36.1	35.5	36.6
145	R-M			21.8	21.0	23.5				
	Pol.			2.2	1.6	2.4				
	Iod.	32.7	35.6	36.4	35.0	36.7	40.1		39.7	36.9
163	R-M	26.0		22.9	22.8	21.9				
	Pcl.	2.5		2.7	1.8	2.9				
	Iod.	28.9	29.5	32.4	36.2	41.3	37.8		41.7	41.6

Table 5. Fat constants of butterfat from raw (R) and pasteurized milk from cows fed rations D, without, and E, with, dehydrated alfalfa pellets as 17 per cent of roughage from 6 to 16 weeks.

Cow	Constant	1949		1950					
		Dec. 14		Jan. 11	Jan. 18		Feb. 8	Feb. 15	Feb. 22
		6	6R	10	11	11R	14	15	16
		Group IV, Ration D for weeks 6, 14, 15, 16 Ration E for weeks 10, 11							
115A*	R-M			28.3	25.7		26.3	26.5	27.2
	Pol.			2.4	1.9		2.3	2.4	2.3
	Iod.	27.7	27.6	24.8	30.0	28.7	25.6	32.2	20.9
152A	R-M			27.6	28.5		27.8		28.2
	Pol.			2.2	2.0		1.9		2.1
	Iod.	33.2	34.2	29.8	27.9	33.2	31.2	31.5	22.6
164A	R-M			34.6	26.8		26.8	26.6	26.3
	Pol.			1.6	1.5		1.6	1.7	3.9
	Iod.	31.6	33.8	35.0	29.6	34.1	31.6	33.4	10.6
270A	R-M			26.0	26.4		27.2		26.2
	Pol.			2.5	2.1		2.6		2.2
	Iod.	30.3	30.2		32.4	29.7	33.0	30.0	26.6
318B	R-M			27.2	26.9		26.7		26.9
	Pol.			2.4	2.4		1.7		2.3
	Iod.	25.6	24.6	25.2	26.0	26.6	25.2	25.2	23.4
394A	R-M			26.2	25.8		26.4		27.5
	Pol.			2.6	2.8		2.6		2.8
	Iod.	26.0	26.1	25.0	21.0	27.8	27.7	24.7	24.8
496A	R-M				30.1		29.9		30.2
	Pol.				2.2		2.6		2.4
	Iod.	27.4	27.8	24.0	24.8	26.0	26.5	24.7	17.7

Table 5. (Concl.).

Cow	Constant	1949		1950					
		Dec. 14		Jan. 11	Jan. 18		Feb. 8	Feb. 15	Feb. 22
		6	6R	10	11	11R	14	15	16
		Group V, Ration E for weeks 6, 14, 15, 16 Ration D for weeks 10, 11							
	R-M				27.0		26.0		26.2
268A	Pol.				2.4		2.5		2.6
	Iod.	26.0	26.5	22.8	21.8	24.8	24.1	25.7	22.0
	R-M			24.9	25.0		25.4	24.3	24.0
128A	Pol.			2.0	2.0		2.5	2.3	1.6
	Iod.	32.1	31.3	29.4	30.0	32.0	29.8	31.2	25.0
	R-M			24.7	27.0		26.5	25.9	26.7
160A	Pol.			1.9	2.2		2.4	2.5	2.2
	Iod.	29.8	31.6	27.6	30.7	30.8	29.3	31.8	19.2
	R-M			25.9	26.5		26.7		25.8
308B	Pol.			2.6	2.5		1.7		2.8
	Iod.	24.6	25.0	22.6	25.2	25.2	26.0	23.0	18.9
	R-M			29.1	29.6		29.2		28.4
391A	Pol.			3.3	3.1		3.4		2.7
	Iod.	24.6	24.3	19.9	22.6		27.1	24.2	26.2
	R-M			27.1	27.4		27.6		28.9
491A	Pol.			2.0	2.2		2.1		1.9
	Iod.	28.0	28.8	24.4	18.7	28.0	30.0	27.2	27.9
	R-M			24.6	24.8		26.0		27.7
316B*	Pol.			2.3	2.5		2.0		2.1
	Iod.	27.3	28.6	26.9	23.0	29.6	27.7	29.4	29.2

* Cow was unable to complete the experiment.

Table 6. Fat constants of butterfat from pasteurized milk from cows fed Ration D, without, and F, with, dehydrated alfalfa pellets as 35 per cent of roughage from 17 to 23 weeks.

Cow	Constant	March 1 17	March 8 18	March 15 19	March 22 20	March 29 21	April 5 22	April 12 23
		Group VI, Ration D for weeks 17, 18, 19, 20, 21, 22 Ration E for week 23						
140A	R-M	28.0	27.8	27.7	28.6	27.8		
	Pol.	2.9	2.7	2.9	2.3	2.9		
	Iod.		27.2	28.4	30.4	27.0	27.4	
160A*	R-M	25.5	31.8	24.6	25.4	25.8		26.4
	Pol.	2.0	2.5	2.1	1.9	1.5		2.3
	Iod.		27.8	31.8	31.2	30.5	30.5	29.7
170A*	R-M	32.7		30.1	31.2	32.1		31.6
	Pol.	2.2		1.9	2.1	2.3		2.4
	Iod.		28.8	32.2	31.6	28.4	29.6	28.2
271A	R-M	26.2	26.0	25.6	25.9	26.2		25.6
	Pol.	2.2	2.4	1.8	1.9	2.2		2.1
	Iod.		25.9	27.2	26.9	29.4	30.3	29.7
273A	R-M			26.2	26.9	27.8		27.0
	Pol.			2.0	1.9	2.2		2.4
	Iod.		26.2	34.0	25.0	32.4	25.5	30.6
300B	R-M	26.3	25.4	25.3	25.4	26.6		27.3
	Pol.	2.4	2.4	2.3	2.5	2.1		3.0
	Iod.		25.0	23.4	24.2	22.0	25.2	21.4

Table 6. (Cont.).

Cow	Constant	March 1 17	March 8 18	March 15 19	March 22 20	March 29 21	April 5 22	April 12 23
		Group VI, Ration D for weeks 17, 18, 19, 20, 21, 22 Ration E for week 23						
301B	R-M	26.1	24.1	25.5	26.0	26.8		24.2
	Pol.	1.4	2.5	1.7	1.4	2.6		1.3
	Iod.		28.7	21.5	29.8	26.2	26.4	27.6
394A	R-M	25.8	24.8	27.3	25.3	25.2		
	Pol.	2.2	2.4	2.5	2.3	2.6		
	Iod.		26.0	25.8	26.4	24.4	26.7	26.4
495A	R-M	29.1	27.4	26.4	29.0	28.3		29.1
	Pol.	1.4	1.5	1.3	1.4	1.4		1.9
	Iod.		32.4	37.4	36.0	31.4	32.6	32.8
		Group VII, Ration E for weeks 17, 18, 19, 20, 21, 22 Ration D for week 23						
155A	R-M	31.3		30.2	30.4	31.2		30.1
	Pol.	3.0		3.1	2.9	3.1		3.2
	Iod.		28.0	30.3	30.7	28.9	29.0	27.4
164A*	R-M	26.4		23.9	24.6	24.3		24.4
	Pol.	2.8		1.5	1.4	1.4		1.3
	Iod.		32.0	30.7	36.0	34.2	36.4	33.4
165A*	R-M	30.8	27.5	20.6	29.2	29.8		
	Pol.	1.6	1.8	3.2	2.0	2.5		
	Iod.		28.0	30.0	29.0	29.1	27.4	28.3

Table 6. (Concl.).

Cow	Constant	March 1	March 8	March 15	March 22	March 29	April 5	April 12
		17	18	19	20	21	22	23
Group VII, Ration E for weeks 17, 18, 19, 20, 21, 22 Ration D for week 23								
391A	R-M	28.4	27.2	26.3	27.9	28.0		27.5
	Pol.	2.8	2.7	2.2	2.9	2.8		2.8
	Iod.		24.0	22.1	24.2	25.1	26.5	24.3
275A	R-M	28.1	29.1	27.1	27.0	29.0		27.8
	Pol.	2.0	3.0	2.8	2.2	2.5		2.4
	Iod.		28.9	29.8	28.4	29.1	27.8	24.6
373A	R-M	28.3	28.2	24.7	28.2			26.8
	Pol.	1.9	3.1	2.2	3.1			2.7
	Iod.		25.6	28.4	26.2		26.8	26.8
305B	R-M	26.2	26.8	26.9	26.2	28.0		27.4
	Pol.	1.7	2.4	2.1	2.2	2.0		2.2
	Iod.		24.0	24.4	23.4	22.7	25.3	23.0
270A	R-M	25.8	25.2	24.8	25.3	26.1		24.5
	Pol.	2.2	2.2	2.3	2.0	2.4		2.1
	Iod.		28.4	31.4	30.6	30.6	36.2	26.6
496A	R-M	29.0	27.5	27.9	29.2	28.4		28.0
	Pol.	2.0	2.4	2.1	2.5	2.0		2.4
	Iod.		24.0	28.0	27.4	26.9	23.0	26.4

* Cow was unable to complete the experiment.

Table 7. Iodine numbers of butterfat from raw (R) and pasteurized milk from cows fed Rations F, with, and D, without, dehydrated alfalfa pellets as 35 per cent of roughage for weeks 24 to 25. Iodine numbers for week 24 were determined when the sample was fresh (f) and after storage for about three months at 5° C.

	April 19				April 26
Cow	24 (f)	24 R (f)	24	24 R	25
Group VI, Ration F for week 24 Ration D for week 25					
140A	30.5	30.6	31.8	30.7	32.0
160A*	33.0	33.4	34.5	35.1	33.4
170A*	28.5	29.2	29.0	31.6	28.6
271A	32.1	31.2	31.0	31.6	
273A	28.4	28.2	29.6	28.0	30.2
300B	28.0	23.8	23.1	24.8	20.6
301B	27.8	30.2	33.1	30.6	27.4
394A	29.6	28.4	30.1	29.0	27.5
495A	25.2	30.3	29.9	29.4	22.9
Group VII, Ration D for week 25 Ration F for week 24					
155A	26.8	26.2	27.8	26.3	26.7
164A*	33.3	33.6	34.7	31.9	35.6
165A*	30.0	27.2	31.4	29.2	29.4
391A	23.8	23.5	24.9	23.7	25.2
275A	25.2	26.4	27.6	26.2	25.6
373A	25.6	22.8	25.1	23.6	25.4
305B	23.4	24.8	23.0	25.2	24.5
270A	29.7	29.2	30.4	30.2	27.2
496A	25.4	24.9	26.4	25.0	41.4

* Cow was unable to complete the experiment.

Table 8. Iodine numbers of butterfat from pasteurized milk determined with and without mercuric acetate as a catalyst from cows fed Rations D, without, and F, with, dehydrated alfalfa pellets as 35 per cent of the roughage for weeks 26 to 32.

Cow		May 3 26	May 10 27	May 17 28	May 24 30	May 31 31	June 7 32
		Group VI, Ration F for weeks 26, 27 Ration D for weeks 28, 30, 31, 32					
140A	Catalyst	25.1	27.5	24.2	30.8	32.3	32.9
	No catalyst	28.9	30.1	26.5	32.9	30.6	31.5
160A*	Catalyst	29.9					
	No catalyst	31.9					
170A*	Catalyst	24.4	30.1	24.4	36.1	34.5	31.1
	No catalyst	27.3	28.4	26.0	36.8	34.4	30.4
271A	Catalyst	27.2	31.6	28.2	45.9	43.9	34.4
	No catalyst	26.2	34.5	30.7	45.5	43.4	34.3
273A	Catalyst	26.8	28.9	30.3	34.3	32.9	33.8
	No catalyst	27.3	29.0	29.7	29.3	33.5	33.2
300B	Catalyst		27.1	21.1	32.0	28.2	28.1
	No catalyst		24.3	23.4	27.4	28.4	27.9
301B	Catalyst	28.1	27.7	26.8	41.3	40.2	29.3
	No catalyst	29.4	26.7	28.9	35.3	41.7	27.7
394A	Catalyst	27.2	27.9	24.7	34.5	32.1	29.5
	No catalyst	28.6	27.5	25.8	33.6	32.4	28.9
495A	Catalyst	30.8	32.5	28.2	39.7	40.4	31.1
	No catalyst	32.3	31.3	29.4	39.8	38.3	29.1

Table 8. (Concl.).

Cow		May 3	May 10	May 17	May 24	May 31	June 7
		26	27	28	30	31	32
		Group VII, Ration D for weeks 26, 27 Ration F for weeks 28, 30, 31, 32					
155	Catalyst	23.3	29.1	23.6	30.3	32.2	34.4
	No catalyst	26.4	26.7	27.3	29.8	31.3	32.7
164A*	Catalyst	32.7					
	No catalyst	36.3					
165A*	Catalyst	33.9	28.2	24.4	34.0		
	No catalyst	34.6	32.2	27.8	33.2		
391A	Catalyst	25.9	28.6	24.7	33.1	34.0	32.3
	No catalyst	24.2	28.2	23.9	32.3	32.0	31.2
275A	Catalyst	27.9	27.0	24.7	32.0	32.3	32.9
	No catalyst	28.2	26.3	25.3	26.7	31.7	31.3
373A	Catalyst	24.5	27.5	25.9	30.5	33.5	29.9
	No catalyst	26.1	27.3	25.2	30.0	31.8	29.3
305B	Catalyst	23.6	24.0	26.0	32.9	33.0	28.7
	No catalyst	22.2	24.7	24.4	26.1	32.2	26.4
270A	Catalyst	29.3	28.0	29.6	38.2	39.7	40.3
	No catalyst	30.0	30.4	32.9	38.9	38.7	39.1
496A	Catalyst	25.1	28.1	26.2	31.6	35.0	31.8
	No catalyst	25.8	26.9	29.7	30.0	31.5	30.3

* Cow was unable to complete the experiment.

Table 9. Iodine numbers of butterfat from two groups of cows fed pasture (Ration G), sun-cured alfalfa hay (Ration H), and dehydrated alfalfa hay (Ration J).

Cow	Iodine number	
	Group VIII fed Ration G	
	1st week	2nd week
155A	40.2	40.3
169A	36.8	36.8
273A	39.3	40.8
	Group VIII fed Ration H	
	3rd week	4th week
155A	30.0	31.2
169A	26.0	28.6
273A	30.4	32.1
	Group VIII fed Ration J	
	5th week	6th week
155A	37.0	36.6
169A	33.4	33.8
273A	35.5	35.6
	Group IX fed Ration G	
	1st week	2nd week
140A	37.7	39.0
170A	39.6	38.5
275A	38.2	37.2
	Group IX fed Ration J	
	3rd week	4th week
140A	36.2	35.2
170A	34.5	34.6
275A	32.8	36.4
	Group IX fed Ration H	
	5th week	6th week
140A	29.8	28.8
170A	31.8	27.0
275A	27.2	26.8

Table 10. Relative Reichert-Meissl and iodine values for Series 1 expressed as percentages of fat constants from butterfats produced on rations shown.

Relative Reichert-Meissl numbers (Ration-ratio x 100)

Group	Ration	Ration-ratio	Week 5	Week 8	Week 9
I	A	B/C	96	95	83
II	B	A/C	116	116	93
III	C	B/A	83	82	89

Group	Ration	Ration-ratio	Week 11	Week 12	Week 14	Week 15	Week 16
II	A	B/C	106	111	96	92	99
I	B	A/C	101	104	104	106	104
III	C	B/A	105	107	92	87	95

Relative iodine numbers (Ration-ratio x 100)

Group	Ration	Ration-ratio	Week 11	Week 12	Week 14	Week 15	Week 16
II	A	B/C	96	104	102	114	113
I	B	A/C	97	87	88	86	93
III	C	B/A	99	120	116	133	122

The fat constants in Table 10 (Series 1) are expressed as a percentage of both the iodine and Reichert-Meissl numbers of butterfat produced on rations containing alfalfa hay or pellets as compared with constants from the control ration containing both hay and pellets. Values are given also for the ratio of these constants for the ration containing pellets expressed as a per cent of the values from the group fed alfalfa hay. No fat constants in this series were determined until the fifth week of the experiment. For weeks 5, 8, and 9 the Reichert-Meissl numbers for the group receiving pellets were respectively 83, 82, and 89 per cent of similar values for the group receiving hay. In the last three weeks of the second period (weeks 14, 15, 16) similar percentages were 92, 87, and 95. For the first two weeks after the reversal of feeds (weeks 11 and 12), the previous relation of Reichert-Meissl numbers is shown by percentages of 105 and 107, respectively. Iodine numbers were not determined for the first feeding period but were nearly equal one week after reversal (week 11) and by the following week had become 20 per cent greater for the group receiving pellets.

Reichert-Meissl numbers of butterfat produced by Groups IV and V fed rations D (alfalfa hay) and E (alfalfa pellets) are studied in Table 11. For the eleventh week the value averaged 27.25. During the sixteenth week it decreased to 27.11. When Snedecor's "t" test was applied to the data in the table, no significance was found between group means.

Table 11. Reichert-Meissl numbers of butterfat produced from two groups of cows fed alfalfa hay (Ration D) and alfalfa pellets (Ration E). Test for significance of mean differences.*

Cow	Week 11 x_1	Week 16 x_2	$X(x_1-x_2)$	Deviation	Squared deviation
			Group IV		
	Ration E	Ration D			
152	28.5	28.2	0.3	0.15833	0.0250
164	26.8	26.3	0.5	0.35833	0.1282
270	26.4	26.2	0.2	0.05833	0.0033
318	26.9	26.9	0.0	-0.14167	0.0202
394	25.8	27.5	-1.7	-1.84167	3.3930
496	30.1	30.2	-0.1	-0.24167	0.0586
			Group V		
	Ration D	Ration E			
268	27.0	26.2	0.8	0.65833	0.4330
128	25.0	24.0	1.0	0.85833	0.7362
160	27.0	26.7	0.3	0.15833	0.0250
308	26.5	25.8	0.7	0.55833	0.3114
391	29.6	28.4	1.2	1.05833	1.1236
491	27.4	28.9	-1.5	-1.64167	2.6896
Total	327.0	325.3	1.7		8.9471
Mean	27.25	27.10833	0.14167		

* $t = 0.54415$

t for 5 per cent level = 2.201

The average Reichert-Meissl numbers for Groups IV, V, VI, and VII (Series 2 and 3) were 27.5, 26.9, 27.0, and 27.7 respectively. Since there were no significant changes in the Reichert-Meissl numbers during periods 3, 4, and 5 (Series 2) of the experiments (Groups IV and V) only iodine values were determined for most of the samples during the third series.

In Series 2, iodine numbers of butterfat produced on ration E (roughage 17 per cent pellets) averaged higher, for two of three periods, than for ration D (control). In Series 3, when 35 per cent of the roughage was dehydrated alfalfa pellets (ration F), the iodine number of the butterfat averaged higher in all three periods than for butterfat produced on ration D. The average iodine numbers for the Groups IV, V, VI, and VII were 25.7, 25.2, 29.1, and 28.9 respectively.

The significance of difference in iodine numbers of the first double reversal tests (Series 2) was tested by the "F" test of Snedecor (22). Table 12 uses values from the final week of each period while Table 13 uses the average of all available values for the last three weeks of each period. In either table the "F" value found was much less than needed for significance at the 5 per cent level. For Series 3, similar studies of the significance of differences in iodine numbers were made for the intervals shown in Tables 14 to 18. Only for the fifth or final week did the test show a difference that was barely significant. The "t" test as applied to group averages in both Series 2 and 3 did not indicate a significant difference. The results of the fourth series (Table 9) do not require an interpretative table. Iodine numbers for both groups of cows were high when they were on pasture. However, when Group IX was fed ration J (chopped dehydrated alfalfa) the iodine number did not drop as low as values for Group VIII in which sun-cured hay was fed. When Group VIII was fed dehydrated alfalfa hay the iodine numbers were increased. Similarly, when Group IX was fed sun-cured alfalfa hay the iodine numbers decreased. This indicates that dehydrated alfalfa hay tends to prevent the decline in iodine number when cows are removed from pasture.

Table 12. Significance of difference in iodine numbers due to feeding dehydrated alfalfa pellets. "F" test* for final weeks of Series 2.

Group	Cow	Weeks			Comparison	Sum
		6	11	16		
		a	b	c	a-2b+c	
		Ration D	Ration E	Ration D		
IV	152	33.2	27.9	22.8	0.0	
	164	31.6	29.6	10.6	-17.0	
	270	30.2	32.4	26.6	- 8.0	
	318	25.6	26.0	23.4	- 3.0	
	394	26.0	21.0	24.8	8.8	
	496	27.4	24.8	17.7	- 4.5	-23.7
		Ration E	Ration D	Ration E		
V	268	26.0	21.8	22.0	4.4	
	128	32.1	30.0	25.1	- 2.8	
	160	29.8	30.7	19.2	-12.4	
	308	24.6	25.2	18.9	- 6.9	
	391	24.6	22.6	26.2	5.6	
	491	28.0	18.7	27.9	18.5	6.4

* F = 0.785
F for 5 per cent level = 4.96

Table 13. Significance of difference in iodine numbers due to feeding dehydrated alfalfa pellets. "F" test* for final three weeks of Series 2.

		Weeks				
		6	10-11	14-15-16	Comparison:	
Group	Cow	a	b	c	a-2b+c	Sum
		Ration D	Ration E	Ration D		
IV	152	33.2	28.9	28.5	3.9	
	164	31.6	32.3	25.2	- 7.8	
	270	30.2	32.4	29.9	- 4.7	
	318	25.6	25.6	24.6	- 1.0	
	394	26.0	23.0	25.7	5.7	
	496	27.4	24.4	23.0	1.6	- 2.3
		Ration E	Ration D	Ration E		
V	268	26.0	22.3	23.9	5.3	
	128	32.1	29.7	28.7	1.4	
	160	29.8	29.2	26.8	- 1.8	
	308	24.6	23.9	22.6	- 0.6	
	391	24.6	21.3	25.8	7.8	
	491	28.0	21.6	28.4	13.2	25.3

* F = 2.15
F for 5 per cent level = 4.96

Table 14. Significance of difference in iodine numbers due to feeding dehydrated alfalfa pellets. "F" test[#] for first weeks of Series 3.

		Weeks				
		18	23	28	Comparison:	
Group	Cow	a	b	c	a-2b+c	Sum
		Ration D	Ration F	Ration D		
VI	271	25.9	29.7	30.7	-2.8	
	273	26.2	30.6	29.7	-5.3	
	300	25.0	21.4	23.4	5.6	
	301	28.7	27.6	28.9	2.4	
	394	26.0	26.4	25.8	-1.0	
	495	32.4	32.8	29.4	-3.8	- 4.9
		Ration F	Ration D	Ration F		
VII	391	24.0	24.3	23.9	-0.7	
	275	28.9	24.6	25.3	5.0	
	373	25.6	26.8	25.2	-2.8	
	305	24.0	23.0	24.4	2.4	
	270	28.4	26.6	32.9	8.1	
	496	24.0	26.4	29.7	0.9	12.9

[#] F = 1.71
F for 5 per cent level = 4.96

Table 15. Significance of difference in iodine numbers due to feeding dehydrated alfalfa pellets. "F" test* for third weeks of Series 3.

Group	Cow	Weeks			Comparison	Sum
		20	25	30		
		a	b	c	a-2b+c	
		Ration D	Ration F	Ration D		
VI	140	30.4	32.0	32.9	- 0.7	
	273	25.0	30.2	29.3	- 6.1	
	300	24.2	20.6	27.4	10.4	
	301	29.8	27.4	35.3	10.3	
	394	26.4	27.5	33.6	5.0	
	495	36.0	22.9	39.8	30.0	48.9
		Ration F	Ration D	Ration F		
VII	155	30.7	26.7	29.8	7.1	
	275	28.4	25.6	26.7	3.9	
	373	26.2	25.4	30.0	5.4	
	305	23.4	24.5	26.1	0.5	
	270	30.6	27.2	38.9	15.1	
	496	27.4	41.4	30.0	-25.4	6.6

* F = 0.86
F for 5 per cent level = 4.96

Table 16. Significance of difference in iodine numbers due to feeding dehydrated alfalfa hay. "F" test* for fourth weeks of Series 3.

Group	Cow	Weeks			Comparison	Sum
		21	26	31		
		a	b	c	a-2b+c	
		Ration D	Ration F	Ration D		
	140	27.0	28.9	30.6	- 0.2	
	271	29.4	26.2	43.4	20.4	
VI	273	32.4	27.3	33.5	11.3	
	301	26.2	29.4	41.7	9.1	
	394	24.4	28.6	32.4	- 0.4	
	495	31.4	32.3	38.3	5.1	45.3
		Ration F	Ration D	Ration F		
	155	28.9	26.4	31.3	7.4	
	391	25.1	24.2	32.0	8.7	
VII	275	29.1	28.2	31.7	4.4	
	305	22.7	22.2	32.2	10.5	
	270	30.6	30.0	38.7	9.3	
	496	26.9	25.8	31.5	6.8	47.1

* F = 0.01
F for 5 per cent level = 4.96

Table 17. Significance of difference in iodine numbers due to feeding dehydrated alfalfa pellets. "F" test* for final weeks of Series 3.

Group	Cow	Weeks 22 a	 27 b	 32 c	Comparison a-2b+c	Sum
		Ration D	Ration F	Ration D		
	140	27.4	30.1	31.5	- 1.3	
	271	30.3	34.5	34.3	- 4.4	
VI	273	25.5	29.0	33.2	0.7	
	300	25.2	24.3	27.9	4.5	
	301	26.4	26.7	27.7	0.7	
	394	26.7	27.5	28.9	0.6	
	495	32.6	31.3	29.1	- 0.9	- 0.1
		Ration F	Ration D	Ration F		
	155	29.0	26.7	32.7	8.3	
	391	26.5	28.2	31.2	1.3	
VII	275	27.8	26.3	31.3	6.5	
	373	26.8	27.3	29.3	1.5	
	305	25.3	24.7	26.4	2.3	
	270	36.2	30.4	39.1	14.5	
	496	23.0	26.9	30.3	- 0.5	33.9

* F = 4.72
F for 5 per cent level = 4.75

Table 18. Significance of differences in iodine numbers due to feeding dehydrated alfalfa pellets. "F" test* for final three weeks of Series 3.

Group	Cow	Weeks 20-21-22 a	Weeks 25-26-27 b	Weeks 30-31-32 c	Comparison a-2b+c	Sum
		Ration D	Ration F	Ration D		
	140	28.3	30.4	31.7	- 0.8	
	271	28.9	30.3	41.1	9.4	
VI	273	27.6	28.8	32.0	2.0	
	300	23.8	22.5	27.9	6.7	
	301	27.5	27.8	34.9	6.8	
	394	25.8	27.9	31.6	1.6	
	495	33.3	28.8	35.7	11.4	37.1
		Ration F	Ration D	Ration F		
	155	29.5	26.6	31.3	7.6	
	391	25.3	25.9	31.8	5.3	
VII	275	28.4	26.7	29.9	4.9	
	373	26.5	26.3	30.4	4.3	
	305	23.8	23.8	28.2	4.4	
	270	32.5	29.2	38.9	13.0	
	496	25.8	31.4	30.6	- 6.4	33.1

* F = 0.04
F for 5 per cent level = 4.75

Differences in the iodine number of butterfats from raw and pasteurized milk are examined by Snedecor's "t" test in Tables 19 to 22. Only in Table 20 for week eleven of the feeding experiment was there a significant difference in average iodine number of butterfat from raw or pasteurized milk. In this comparison the raw samples had the higher average iodine number. In Table 22 the iodine numbers from raw samples averaged slightly less than from pasteurized samples. This difference was not significant and the three comparisons in Tables 19, 20, and 21 indicate no consistent significant difference. For samples collected during the sixth, eleventh, and twenty-fourth weeks, butterfats from raw and pasteurized milk, stored three months, had respective average iodine numbers of 28.69 and 28.26, 29.16 and 26.21, 27.45 and 28.13. For fresh fat samples from the twenty-fourth week similar values were 27.18 and 27.25.

Table 19. Significance of mean difference, "t" test*, between iodine numbers of butterfat from raw (R) and pasteurized milk. Samples were collected during the sixth week and stored three months.

Cow	6 (R) a	6 b	a-b
		Group IV	
152	34.2	33.2	1.0
164	33.8	31.6	2.2
270	30.3	30.2	0.1
318	24.6	25.6	-1.0
394	26.1	26.0	0.1
496	27.8	27.4	0.4
		Group V	
268	26.5	26.0	0.5
128	31.3	32.1	-0.8
160	31.6	29.8	1.8
308	25.0	24.6	0.4
391	24.3	24.6	-0.3
491	28.8	28.0	0.8
Total	344.3	339.1	
Mean	28.692	28.258	$\bar{x}$ = 0.433

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* t = 1.391
t for 5 per cent level = 2.201

Table 20. Significance of mean difference, "t" test*, between iodine numbers of butterfat from raw (R) and pasteurized milk. Samples were collected during the eleventh week and stored three months.

	11 (R)	11	
Cow	a	b	a-b
	Group IV		
152	33.2	27.9	5.3
164	34.1	29.6	4.5
270	29.7	32.4	-2.7
394	27.8	21.0	6.8
496	26.0	24.8	1.2
	Group V		
268	24.8	21.8	3.0
128	32.0	30.0	2.0
160	30.8	30.7	0.1
308	25.2	25.2	0
491	28.0	18.7	9.3
Total	291.6	262.1	
Mean	29.16	26.21	$\bar{x} = 2.95$

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* t = 2.601
t for 5 per cent level = 2.262

Table 21. Significance of mean difference, "t" test*, between iodine numbers of butterfat from raw (R) and pasteurized milk. Samples were collected during the twenty-fourth week and stored three months.

Cow	24 a	24 (R) b	a-b
	Group VI		
140	31.8	30.7	1.1
271	31.0	31.6	-0.6
273	29.6	28.0	1.6
300	23.1	24.8	-1.7
301	33.1	30.6	2.5
394	30.1	29.0	1.1
495	29.9	29.4	0.5
	Group VII		
155	27.8	26.3	1.5
391	24.9	23.7	1.2
275	27.6	26.2	1.4
373	25.1	23.6	1.5
305	23.0	25.2	-2.2
270	30.4	30.2	0.2
496	26.4	25.0	1.4
Total	393.8	384.3	
Mean	28.13	27.45	$\bar{x}$ = 0.6786

* t = 1.908
t for 5 per cent level = 2.160

Table 22. Significance of mean difference, "t" test*, between iodine numbers of butterfat from raw (R) and pasteurized milk. Samples were collected during the twenty-fourth week and analyzed without storage.

Cow	24 a	24 (R) b	a-b
	Group VI		
140	30.5	30.6	-0.1
271	32.1	31.2	0.9
273	28.4	28.2	0.2
300	28.0	23.8	4.2
301	27.8	30.2	-2.4
394	29.6	28.4	1.2
495	25.2	30.3	-5.1
	Group VII		
155	26.8	26.2	0.6
391	23.8	23.5	0.3
275	25.2	26.4	-1.2
373	25.6	22.8	2.8
305	23.4	24.8	-1.4
270	29.7	29.2	0.5
496	25.4	24.9	0.5
Total	381.5	380.5	
Mean	27.25	27.1786	$\bar{x}$ = 0.0714

* t = 0.121
t for 5 per cent level = 2.160

Iodine numbers with and without mercuric acetate catalyst are compared in Table 23. Snedecor's "t" test indicated no significant difference. For the 82 samples compared, the average iodine numbers were 30.17 without catalyst and 30.58 with catalyst. The presence of 1 mg catalyst per sample did reduce the reaction time to one minute as found for most other fats by Benham and Klee (7).

The standard deviation within 534 pairs of duplicate determinations including over 50 rejected and repeated was 0.84 unit. From the last 344 pairs the standard deviation within pairs of duplicates was found to be 0.55 unit.

Table 23. Iodine numbers of butterfat determined with and without mercuric acetate catalyst.

Cow	Catalyst a	No catalyst b	a-b	Cow	Catalyst a	No catalyst b	a-b	Cow	Catalyst a	No catalyst b	a-b
	Week 26				Week 28				Week 31		
140	25.1	28.9	-3.8	140	24.2	26.5	-2.3	140	32.3	30.6	1.7
155	23.3	26.4	-3.1	155	23.6	27.3	-3.7	155	32.2	31.3	0.9
271	27.2	26.2	1.0	271	28.2	30.7	-2.5	271	43.9	43.4	0.5
391	25.9	24.2	1.7	391	24.7	23.9	0.8	391	34.0	32.0	2.0
273	26.8	27.3	-0.5	273	30.3	29.7	0.6	273	32.9	33.5	-0.6
275	27.9	28.2	-0.3	275	21.1	23.4	-2.3	275	32.3	31.7	0.6
373	24.5	26.1	-1.6	373	25.9	25.2	0.7	300	28.2	28.4	-0.2
301	28.1	29.4	-1.3	301	26.8	28.9	-2.1	373	33.5	31.8	1.7
305	23.6	22.2	1.4	305	26.0	24.4	1.6	301	40.2	41.7	-1.5
394	27.2	28.6	-1.4	394	24.7	25.8	-1.1	305	33.0	32.2	0.8
270	29.3	30.0	-0.7	270	29.6	32.9	-3.3	394	32.1	32.4	-0.3
495	32.3	30.8	1.5	495	28.2	29.4	-1.2	270	39.7	38.7	1.0
496	25.1	25.8	-0.7	496	26.2	29.7	-3.5	495	40.4	38.3	2.1
								496	35.0	31.5	3.5

Table 23. (Concl.).

Cow	Catalyst a	No catalyst b	a-b	Cow	Catalyst a	No catalyst b	a-b	Cow	Catalyst a	No catalyst b	a-b
	Week 27				Week 30				Week 32		
140	27.5	30.1	-2.6	140	30.8	32.9	-2.1	140	32.9	31.5	1.4
155	29.1	26.7	2.4	155	30.3	29.8	0.5	155	34.4	32.7	1.7
271	31.6	34.5	-2.9	271	45.9	45.5	0.4	271	34.4	34.3	0.1
391	28.6	28.2	0.4	391	33.1	32.3	0.8	391	32.3	31.2	1.1
273	28.9	29.0	-0.1	273	34.3	29.3	5.0	273	33.8	33.2	0.6
275	27.0	26.3	0.7	275	32.0	26.7	5.3	275	32.9	31.3	1.6
300	27.1	24.3	2.8	300	32.0	27.4	4.6	300	28.1	27.9	0.2
373	27.5	27.3	0.2	373	30.5	30.0	0.5	373	29.9	29.3	0.6
301	27.7	26.7	1.0	301	41.3	35.3	6.0	301	29.3	27.7	1.6
305	24.0	24.7	-0.7	305	32.9	26.1	6.8	305	28.7	26.4	2.3
394	27.9	27.5	0.4	394	34.5	33.6	0.9	394	31.8	30.3	1.5
270	28.0	30.4	-2.4	270	38.2	38.9	-0.7	270	31.1	29.1	2.0
495	32.5	31.3	-1.2	495	39.7	39.8	-0.1	495	40.3	39.1	1.2
496	28.1	26.9	1.2	496	31.6	30.0	1.6	496	29.5	28.9	0.6
Total					2507.5	2473.8					
Mean					30.5793	30.1683					

t = 0.5626
t for 5 per cent level = 1.990

SUMMARY

When alfalfa pellets were fed to dairy cows as the sole roughage the Reichert-Meissl number of butterfat was lowered and the iodine number increased as compared with a roughage of alfalfa hay. After a reversal in feed the iodine numbers changed much more quickly than the Reichert-Meissl numbers. Feeding cows dehydrated alfalfa pellets as 17 per cent of their roughage did not change the Reichert-Meissl or iodine numbers of their butterfat. However, when pellets were increased to 35 per cent of the roughage, a significant increase in iodine numbers, averaging 2.43 units, was observed. Dehydrated alfalfa prevented to a considerable extent the decrease in iodine number when cows were removed from pasture. No significant change in iodine numbers was caused by storing butter oil from raw or pasteurized milk at 5° C. for three months. The use of one mg of mercuric acetate per thirty mg fat reduced the reaction time with pyridine sulfate dibromide reagent from 15 minutes to 1 minute but did not change the iodine numbers.

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EFFECTS OF FEEDING DEHYDRATED ALFALFA PELLETS UPON SOME FAT CONSTANTS OF BUTTERFAT

by

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In a study to determine the effects of feeding dehydrated alfalfa pellets upon the fat constants of butterfat from pasteurized milk, a total of nine rations were fed in four series of experiments to dairy cows. In Series 1 chopped sun-cured alfalfa hay, dehydrated alfalfa pellets, and a mixture of hay and pellets (control) was fed as the sole roughage. A single reversal feeding experiment was used to compare the rations. The roughage for Series 2 consisted of silage and chopped sun-cured alfalfa hay (control) or dehydrated alfalfa pellets as 17 per cent of the roughage. During Series 3 a similar ration was used in which about 35 per cent of the roughage was dehydrated alfalfa pellets. In both Series 2 and 3 double reversal feeding trials were used to compare the rations. For Series 4 the roughages were composed of pasture, chopped sun-cured alfalfa hay, and chopped dehydrated alfalfa. In all series a grain mixture consisting of corn, oats, bran, soybean oil meal, salt, and bone meal was fed to the cows.

As the sole roughage alfalfa pellets decreased the Reichert-Meissl number and increased the iodine number when compared with a roughage of alfalfa hay. After a reversal in feed the iodine number changed much more rapidly than the Reichert-Meissl numbers.

No change in the fat constants was observed when alfalfa pellets were fed as 17 per cent of the roughage.

When 35 per cent of the roughage was alfalfa pellets an increase in the iodine number was observed.

In Series 4 the effects of machine dehydrating without grinding was studied. Iodine numbers for the cows were high when they were on pasture. Results from this study indicate that dehydrated alfalfa hay prevents most of the decrease in iodine number when the cows were removed from pasture.

On three occasions during the experiment both raw and pasteurized milk samples were collected. Iodine numbers were determined for fresh and stored samples. When the butterfat was stored for three months the iodine numbers were somewhat, but not significantly higher.

Iodine numbers of 82 samples were determined with and without mercuric acetate as a catalyst. The average iodine number samples determined with mercuric acetate catalyst was about 0.4 unit higher than iodine numbers determined without catalyst. The catalyst reduces the reaction time from 15 minutes to 1 minute without a significant change in iodine numbers.

The standard deviation within 534 pairs of duplicate sample determinations including over 50 rejected results was 0.84 unit. For the last 344 pairs of determinations the standard deviation within duplicates was 0.55 unit.

Date Due